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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/686,896

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Alan R. Arthur

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HEWLETT PACKARD COMPANY

P O BOX 272400, 3404 E. HARMONY ROAD

INTELLECTUAL PROPERTY ADMINISTRATION

FORT COLLINS, CO 80527-2400

EXAMINER

CHUO, TONY SHENG HSIANG

ART UNIT

PAPER NUMBER

1745

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/686,896	<b>Applicant(s)</b> ARTHUR ET AL.	
	<b>Examiner</b> Tony Chuo	<b>Art Unit</b> 1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 27 April 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-65 is/are pending in the application.
- 4a) Of the above claim(s) 39-60 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7, 9-24, 29-38 and 61-65 is/are rejected.
- 7) ☒ Claim(s) 8 and 25-28 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |                                                                                                            |                                                                                         |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____                                                |

## **DETAILED ACTION**

### ***Response to Amendment***

1. Claims 1-65 are currently pending. Claims 39-60 are withdrawn from further consideration as being drawn to a non-elected invention. Claims 1-38 and 61-65 do overcome the previously stated 102 and 103 rejections. However, upon further consideration, claims 1-7, 9-24, 29-38, and 61-65 are rejected under the following new 102 and 103 rejections.

### ***Claim Objections***

2. Claim 13 is objected to because of the following informalities: in line 3, the phrase "flow or fuel" should be changed to "flow of fuel". Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-5, 7, 11-14, 61, and 62 are rejected under 35 U.S.C. 102(b) as being anticipated by Bostaph et al (US 2002/0076598).

Regarding claims 1, 61, and 62, the Bostaph reference discloses a fuel cell system comprising: a substrate "27" & "14"; an array of fuel cells "10", each having an anode "18", a cathode "22", and an electrolyte "20" disposed on the substrate; current collectors "28" electrically coupled to the fuel cell array; a fuel flow channel "60" defined

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in anode side of the substrate; and a cathode air flow channel "29" defined in a cathode side of the substrate (See paragraphs [0018],[0022],[0024],[0027] and Figure 1).

Examiner's note: Claim 61 appears to invoke 35 USC 112, sixth paragraph. The substrate "27" & "14" is construed as an equivalent structure for supporting an array of fuel cells. The cathode air flow channel "29" is construed as an equivalent structure for conveying cathode air across the array of fuel cells. The fuel flow channel "60" is construed as an equivalent structure for conveying fuel across the array of fuel cells. The current collectors "28" are construed as an equivalent structure for removing electricity from the array of fuel cells.

Regarding claims 2 and 3, it also discloses a fuel inlet "30" and a fuel outlet "52" that are defined in the substrate and are in fluid communication with the fuel flow channel (See paragraphs [0019],[0020] and Figure 1).

Regarding claims 4 and 5, it also discloses a cathode air inlet "29" and an excess cathode air outlet "28" that are defined in the substrate and are in fluid communication with the cathode air flow channel (See Figure 1).

Regarding claim 7, it also discloses an array of fuel cells "12" that are disposed with the fuel flow channel and the cathode air flow channel (See Figure 1).

Regarding claim 11, it also discloses current collectors "28" that are located on the cathode side of the substrate, wherein the cathode side serves as a circuit side of the substrate (See paragraph [0024]).

Regarding claim 12, it also discloses an electrolyte "20" that seals non-active portions of the substrate (See Figure 1).

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Regarding claims 13 and 14, it also discloses flow modification features "66" associated with the fuel flow channel "72", wherein the flow modification features are configured to distribute a flow of fuel emerging from an inlet across the width of the fuel flow channel, wherein the flow modification features comprise a plurality of baffles (See Figure 2).

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Wilkinson et al (US 5773160). The Bostaph reference is applied to claims 1, 2, and 4 for reasons stated above.

However, Bostaph et al does not expressly teach a fuel inlet and outlet in the first and second opposing corner portions and an air inlet and outlet in third and fourth opposing corner portions of the substrate. The Wilkinson reference teaches a flow field plate that could also be a substrate for fuel cells that is rectilinear and comprises a fuel inlet "244" and fuel outlet "246" in the first and second opposing corner portions and an air inlet "240" and air outlet "242" in third and fourth opposing corner portions of the substrate (See Figure 6A).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph fuel cell to include a fuel inlet and outlet in the first and second opposing corner portions and an air inlet and outlet in third and fourth opposing corner portions of the substrate so that the overall size of the fuel cell can be reduced by centrally locating the inlets and outlets on the same substrate.

7. Claims 9, 10, and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Takayanagi (JP 08-213043). The Bostaph reference is applied to claims 1 and 61 for reasons stated above.

However, Bostaph et al does not expressly teach fuel flow channels along a first axis and cathode air flow channels along a second axis disposed at an angle that is substantially normal to the first axis. The Takayanagi reference teaches a layered fuel cell with fuel flow channels "45" that are perpendicular to the cathode air flow channels "44" (See Drawing 4).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph fuel cell to include fuel flow channels that are perpendicular to the cathode air flow channels so that the fuel gas and air gas can be more efficiently delivered to the fuel cells.

8. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598). The Bostaph reference is applied to claim 1 for reasons stated above. However, Bostaph et al does not expressly teach conductors that are located on the anode side of the substrate, wherein the anode side serves as a circuit side of the fuel cell. However, it would have been obvious to one of ordinary skill in the

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art at the time the invention was made to modify the Bostaph fuel cell to include conductors that are located on the anode side of the substrate, wherein the anode side serves as a circuit side of the fuel cell because rearrangement of parts was held to have been obvious (In re Japikse 86 USPQ 70 (CCPA 1950)).

9. Claims 16, 32-34, 36, 63, and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051). The Bostaph reference discloses a fuel cell system comprising: a substrate "27" & "14"; an array of fuel cells "10", each having an anode "18", a cathode "22", and an electrolyte "20" disposed on the substrate; current collectors "28" electrically coupled to the fuel cell array; a fuel flow channel "60" defined in anode side of the substrate; and a cathode air flow channel "29" defined in a cathode side of the substrate (See paragraphs [0018],[0022],[0024],[0027] and Figure 1). It also discloses a fuel inlet "30" and a fuel outlet "52" that are defined in the substrate and are in fluid communication with the fuel flow channel (See paragraphs [0019],[0020] and Figure 1). It also discloses a cathode air inlet "29" and an excess cathode air outlet "28" that are defined in the substrate and are in fluid communication with the cathode air flow channel (See Figure 1). It also discloses current collectors "28" that are located on the cathode side of the substrate, wherein the cathode side serves as a circuit side of the substrate (See paragraph [0024]). It also discloses an electrolyte "20" that seals non-active portions of the substrate (See Figure 1).

However, Bostaph et al does not expressly teach a plurality of fuel cell layers each including an array of fuel cells, wherein the fuel cell layers are alternately

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stacked; a plurality of supporting means, wherein a plurality of supporting means comprises means for delivering and removing fuel and cathode air to and from the system; seals disposed around the inlets, exhaust and outlet and around the perimeter of the fuel cell array; and fuel cell layers that are coupled so as to form a parallel electrical circuit. The Haluzak reference discloses a plurality of fuel cell layers "40" each including an array of fuel cells, wherein the fuel cell layers are alternately stacked (See Figure 5). It also discloses inlets, outlets, and perimeter of the array that are sealed with epoxy (See paragraph [0037]). It also discloses fuel cell layers that are coupled to form a parallel electrical circuit.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph fuel cell to include a plurality of fuel cell layers each including an array of fuel cells, wherein the fuel cell layers are alternately stacked; a plurality of supporting means, wherein a plurality of supporting means comprises means for delivering and removing fuel and cathode air to and from the system; seals disposed around the inlets, exhaust and outlet and around the perimeter of the fuel cell array; and fuel cell layers that are coupled so as to form a parallel electrical circuit in order to maximize the energy density of the fuel cell system stacking fuel cell layers.

10. Claims 17-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) as applied to claim 16, above, and further in view of Takayanagi (JP 08-213043).



However, Bostaph et al as modified by Haluzak does not expressly teach fuel cell layers that are coupled such that a fuel cell layer shares a fuel flow channel with a first adjacent fuel cell layer thereby forming a fuel flow plenum; fuel cell layers that are coupled such that a fuel cell layer shares a cathode air flow channel with a second adjacent fuel cell layer thereby forming a cathode air flow plenum; a plurality of fuel inlets that form a fuel inlet plenum and a plurality of exhausts that form a fuel exhaust plenum; fuel inlet plenum and exhaust plenum that are in fluid communication with the fuel flow plenum; a plurality of cathode air inlets that form a cathode air inlet plenum and a plurality of excess cathode air outlets that form an excess cathode air plenum; cathode air inlet plenum and excess cathode air outlet plenum that are in fluid communication with the cathode air flow plenums. The Takayanagi reference discloses flow channels that form fuel inlet, fuel outlet, air inlet, and air outlet manifolds (See Figure 3).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak fuel cell system to include fuel cell layers that are coupled such that a fuel cell layer shares a fuel flow channel with a first adjacent fuel cell layer thereby forming a fuel flow plenum; fuel cell layers that are coupled such that a fuel cell layer shares a cathode air flow channel with a second adjacent fuel cell layer thereby forming a cathode air flow plenum; a plurality of fuel inlets that form a fuel inlet plenum and a plurality of exhausts that form a fuel exhaust plenum; fuel inlet plenum and exhaust plenum that are in fluid communication with the fuel flow plenum; a plurality of cathode air inlets that form a cathode air inlet plenum and

a plurality of excess cathode air outlets that form an excess cathode air plenum; cathode air inlet plenum and excess cathode air outlet plenum that are in fluid communication with the cathode air flow plenums in order to deliver fuel and air to the fuel cells more efficiently.

11. Claims 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) as applied to claim 16 above, and further in view of Nguyen (US 6503651).

However, Bostaph et al as modified by Haluzak does not expressly teach fuel flow channels or air flow channels comprising ports that can be opened or closed to selectively activate or deactivate each individual layer of the plurality of layers. The Nguyen reference teaches a fuel cell stack comprising ports "353", "354", "355" with valves "340" that can be opened or closed to selectively activate or deactivate each individual fuel cell in the fuel cell stack (See Figure 6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak fuel cell system to include fuel flow channels or air flow channels comprising ports that can be opened or closed to selectively activate or deactivate each individual layer of the plurality of layers in order to improve the nonuniformity in flow resistance among the cells in the stack that leads to nonuniform cell-to-cell performance and non-optimal stack performance.

12. Claims 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) as applied to claim 16 above, and further in view of Takayanagi (JP 08-213043).

However, Bostaph et al as modified by Haluzak does not expressly teach fuel flow channels along a first axis and cathode air flow channels along a second axis disposed at an angle that is substantially normal to the first axis. The Takayanagi reference teaches a layered fuel cell with fuel flow channels "45" that are perpendicular to the cathode air flow channels "44" (See Drawing 4).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak fuel cell to include fuel flow channels that are perpendicular to the cathode air flow channels so that the fuel gas and air gas can be more efficiently delivered to the fuel cells.

13. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) as applied to claims 16 and 34 above, and further in view of Mook et al (US 2003/0235745).

However, Bostaph as modified by Haluzak does not expressly teach seals that comprise an electrically conductive material. The Mook reference does teach a seal that is electrically conductive (See Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak fuel cell to include seals that are electrically conductive in order to allow the flow of electric current between the anode and the cell manifold.

14. Claims 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) and Takayanagi (JP 08-213043) as applied to claim 24 above, and further in view of Nguyen

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(US 6503651). However, Bostaph as modified by Haluzak and Takayanagi does not expressly teach fuel and cathode air manifolds that have a plurality of selectively opened inlet ports coupled to flow plenums disposed with the inlet plenum, and exhaust manifold that have a plurality of selectively opened inlet ports coupled to flow plenums disposed with the exhaust plenum. The Nguyen reference teaches a fuel cell stack comprising ports "353", "354", "355", "356", "357", "358" with valves "340" that can be opened or closed to selectively activate or deactivate each individual fuel cell in the fuel cell stack (See Figure 6). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak/Takayanagi fuel cell system to include fuel and cathode air manifolds that have a plurality of selectively opened inlet ports coupled to flow plenums disposed with the inlet plenum and exhaust manifold that have a plurality of selectively opened inlet ports coupled to flow plenums disposed with the exhaust plenum in order to improve the nonuniformity in flow resistance among the cells in the stack that leads to nonuniform cell-to-cell performance and non-optimal stack performance.

***Allowable Subject Matter***

15. Claims 8 and 25-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The Bostaph reference teaches conductors that are electrically coupled to the fuel cell array. However, it does

not expressly teach conductors that comprise a positive conductor extending to the cathode air inlet and a negative conductor extending to excess cathode air outlet.

### ***Response to Arguments***

16. Applicant's arguments with respect to claims 1-7, 9-24, 29-38, and 61-65 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tony Chuo whose telephone number is (571) 272-0717. The examiner can normally be reached on M-F, 8:30AM to 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

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USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TC



**JONATHAN CREPEAU**  
**PRIMARY EXAMINER**